	L #	Hits	Search Text
1	L1	1248	multi$5 adj domain
2	L2	1712	chiral near3 nematic
3	L8	266882	pvcn or pscn or celcn or uv or ultraviolet
4	L14	282403	positive near8 negative
5	L20	196	negative adj (uniaxial or biaxial)
6	L38	0	32 and 20
7	L26	11	1 and 2 and 8
8	L32	5	26 and 14
9	L44	17	1 and 2
10	L50	4	"6067140"
11	L62	2	"6168324"
12	L68	21	1 and 8 and 14 and (nematic or stn or tn)
13	L80	808	(negative and positive) near5 (dielectric adj anisotropy)
14	L86	11	80 and 1

W04

:VALID *TDB-ACC-NO: NN9312547

DISCLOSURE TITLE: Symmetrical Multicolor Multi-Domain Homeotropic and Hybrid Oriented Nematic Liquid Crystal Displays using Periodic Triangular Tooth Waveform Surfaces

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DISCLOSURE TEXT:

Disclosed is a multicolor homeotropic oriented nematic Liquid Crystal Display (LCD), using a periodic triangular tooth waveform surface and the conventional homeotropic surface alignment to give a multi-domain LCD with a symmetrical angular optical performance.

- In the present disclosed LCD device, the first substrate has a one-dimensional periodic triangular tooth waveform surface, and the second substrate has a conventional flat surface. Both surfaces are treated to give a homeotropic alignment, with or without a pretilt angle. The liquid crystal used should have a negative dielectric anisotropy so that under the presence of an external field, it will orientate perpendicular to the field direction. The surface alignment is homeotropic, but the liquid crystal orientation will have an asymmetrical structure due to the triangular tooth surface. The cell gives a complete black field-off state for all colors. Thus, very high contrast ratio for all colors can be obtained, and the viewing angle is significantly improved.

Also, an excellent grey scale performance is obtained for all colors, with a symmetrical angular optical performance for an operation voltage range of more than 7 volts.

- In general, the one-dimensional periodic waveform substrates can be fabricated by the following three methods, where the replication method gives a relatively inexpensive technique to make

large quantities of substrates and is more appropriate to fabricate the substrates for the present LCD application.

1. Using direct cutting - The substrate can be made by direct cutting of the substrate to the periodic surface waveform.
2. Using photosensitive glass - The substrate can be made using photosensitive glass. First, the photosensitive glass is exposed to the ultraviolet (uv) light with the desired periodic waveform pattern. After the uv exposition, the pattern is developed by heat treatment.

   Because of a pronounced difference in chemical solubility between the exposed and unexposed areas, the expose pattern can be etched out with hydrofluoric acid. An exact copy of the master or negative was then obtained through which the exposure was made.
3. Using replication process - The substrate can be made using the replication process, in which the surface of a master is transferred to a substrate by a thin film epoxy. The master has a surface quality desired in the replica and the required periodic waveform surface. A hot epoxy is put on the glass substrate. The master is then sandwiched and epoxied to the substrate. When the epoxy is cured and the pieces are separated, the periodic waveform pattern is then replicated to the substrate.

   The substrate now has a periodic waveform surface that can be used for the cell fabrication. Only one master is required to make large quantities. The material used for the master may be glass, Pyrex, cervit, stainless steel, copper, nickel, nickel plated aluminum, or diamond. The surfaces made by the replication process should be of comparable quality to the master. Besides epoxy, other soft transparency materials can be used for the substrates, such as the plastic materials and polycarbonate materials.

This device can have the following other geometries:

1. The pretilt angles at the two surfaces can be of different values.

   These include the hybrid oriented nematic LCDs, in which the liquid crystal alignment is a homeotropic alignment at one surface, and is or close to a parallel orientation with a small pretilt angle at the other surface. For the hybrid oriented LCD, the liquid crystal used can have either a positive or negative dielectric anisotropic.
2. Other kinds of periodic surfaces can be used for fabricating the LCD. These include a periodic ramp tooth surface, a concavity surface and a convexity surface.
3. The periodic surface can be used for both substrates.

4. The period (L) of the periodic triangular tooth surface might not necessarily be equal to the width (W) of a pixel. L can be either smaller or equal to W. For L=W, resulting in a two-domain symmetrical LCD. For L=W/n with n=2, 3, 4---, we have a 2n-domain symmetrical LCD.